

CLAIMS

1. Device for leak-tight sealing of packaging containers for products sensitive to ambient pollutants and for purification treatment of ambient air in these packaging  
5 containers, with controlled amplitude of the opening angle and mechanically assisted opening and closing, to be installed on the tubular casing of the access opening to said container, the said device being made of thermoplastic polymer materials and comprising:
- 10 - a leak-tight sealing means (1) of the access opening of the container, with a means of packaging an ambient air treatment agent on its inner face
- a means of assembly (2) of the sealing means onto the tubular casing of the access opening,
- 15 - a connection means (3) between the sealing means and the assembly means,
- a first opening tamper resistance means (8), placed between the sealing means (1) and the assembly means (2), characterised in that it comprises:
- 20 a) a male type stopper-cap (1) as the sealing means of the opening in the tubular casing of the container, composed of an upper end wall on which a first coaxial peripheral wall (11) is mounted setting up a leak-tight contact with the inner surface of the tubular casing of the container (5)
- 25 access opening (4), and a second wall (12) internal to the first wall, forming the packaging means for the ambient air treatment agents,
- b) as assembly means of the sealing means, an assembly ring (2) mounted on the tubular casing of the container access

opening (4), the inner face of which is provided with a means of attachment of the outer face of the casing,

c) as connection means (3) between the assembly means (2) and the sealing means (1), two distinct hinges (6) and (7) at a spacing from each other,

d) as first opening tamper resistance means (8), a peripheral series of connecting micro-dots or a peripheral strip to be torn off, or a combination of these two means placed between the sealing means and the assembly means,

10 e) a mechanical assistance means (9) for opening and closing and controlling the amplitude of the opening angle of the sealing means (1), placed in the space located between the two hinges (6) and (7) and simultaneously connected to the stopper-cap (1) through a film hinge (21), and to the attachment ring (2) fastening the device onto the casing (24) by another film hinge (22), the section through the said mechanical assistance means being in the form of a bracket.

20 2. Device according to claim 1, characterised in that the cross-section of the first coaxial peripheral wall (11) of the sealing means (1) setting up the leak-tight contact with the inner surface of the tubular casing (24) of the opening (4) of the container (5) includes a peripheral swelling (14) developing on its outer face.

3. Device according to claim 2, characterised in that the outer peripheral swelling (14) of the first wall (11) is deformed when in contact with the inner wall of the tubular casing (24) of the opening (4) to increase the contact

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surface area between these two walls and to reinforce the leak-tightness.

4. Device according to claim 1, characterised in that the  
5 packaging means (12) of ambient air treatment agents, placed on the inner face of the stopper-cap (1) is preferably of the tubular type.

5. Device according to claim 4, characterised in that the  
10 packaging means (12) of ambient air treatment agents is provided with open cells each being designed to contain a treatment agent or a mix of treatment agents.

6. Device according to at least one of claims 1, 4 or 5,  
15 characterised in that the packaging means (12) of ambient air treatment agents, contains treatment agents capable of eliminating gaseous pollutants, and particularly water vapour, oxygen ( $O_2$ ), ammonia ( $NH_3$ ), alcohols, aldehydes, ketones, sulphur dioxide ( $SO_2$ ), hydrogen sulphide ( $H_2S$ ),  
20 mercaptans, alkenes particularly including ethylene, alkynes, carbon dioxide ( $CO_2$ ), carbon monoxide ( $CO$ ), nitrogen dioxide ( $NO_2$ ), alkanes and particularly methane ( $CH_4$ ), halogens and particularly fluorine, bacteria present in the ambient air.

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7. Device according to claim (6), characterised in that when the pollutant is water vapour, the treatment agent is chosen from the group composed of silica gels, molecular sieves in powdery form or deposited on a powdery support.

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8. Device according to at least one of claims 1 to 7, characterised in that the stopper-cap (1) is provided with a gripping visor (17).

5 9. Device according to at least one of claims 1 to 8, characterised in that the stopper-cap (1) is provided with a child opening safety system (23).

10 10. Device according to claim 9, characterised in that the safety system is installed adjacent to the visor (17).

11. Device according to claim 9 or 10, characterised in that the opening safety system (23) is a flexible strip surrounding the visor and forming an integral part of the  
15 assembly means (2).

12. Device according to at least one of claims 1 to 11, characterised in that the inner face of the stopper-cap (1) outer wall and the outer face of the outer wall of the  
20 tubular casing (24) of the access opening (4) of the container (5) are provided with a click fit means.

13. Device according to at least one of claims 1 to 12, characterised in that the assembly means (2) of the stopper-  
25 cap (1) is an attachment ring (2) mounted on the tubular casing (24) of the access opening (4), provided with a click fit means on its inner face facing the outer face of the tubular casing (24), on which there is also a click fit means.

14. Device according to at least one of claims 1 to 13, characterised in that the assembly means (2) is force fitted on the tubular casing (24).

5 15. Device according to at least one of claims 1 to 12, characterised in that the assembly means (2) is mounted by bonding on the tubular casing (24).

10 16. Device according to at least one of claims 1 to 12, characterised in that the outer peripheral surface of the tubular casing (24) of the access opening to the container to be sealed comprises two projecting peripheral collars (26) and (27), separated from each other by creating a groove (25) with an approximately rectangular shaped  
15 section, the thickness of the tubular casing inside the groove is not modified, and the attachment ring (2) is force fitted into the said groove (25).

17. Device according to at least one of claims 1 to 12,  
20 characterised in that a peripheral groove (25) that may have an approximately rectangular, hemispherical or semi-elliptical shaped section, is made recessed within the thickness of the wall of the tubular casing of the container (24), the thickness of the tubular casing inside the groove  
25 being modified, and being less than the thickness of the tubular casing and the attachment ring force fitted into the said groove.

18. Device according to at least one of claims 16 to 17,  
30 characterised in that the inner surface of the attachment ring is provided with click fit means which, when the said

attachment ring is force fitted into the groove of the container, itself equipped with complementary click fit means, fits into the corresponding click fit means so as to block any rotation or translation of the stopper with  
5 respect to the container.

19. Device according to claim 18, characterised in that the said click fit means on the inner surface of the attachment ring and on the inner surface of the groove in the container  
10 are splines or slots.

20. Device according to at least one of claims 1 to 19, characterised in that the two hinges (6) and (7) of the connecting means (3) are film hinges.  
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21. Device according to claim 20, characterised in that each film hinge (6) or (7) is formed from two parts forming brackets connected together by a polymer film acting as an axis of rotation to enable opening - closing cycles of the  
20 sealing means, one of the parts being integrated into the sealing means and the other part being integrated into the assembly means.

22. Device according to at least one of claims 1 to 21,  
25 characterised in that the amplitude of the opening angle controlled by the mechanical assistance means (9) is not more than 160° and preferably between 90° and 160°.

23. Device according to at least one of claims 1 to 22,  
30 characterised in that the angular deformation of the mechanical assistance means in the form of a bracket between

its closed position and its open position is between 0° and not more than 30° and preferably between 0° and not more than 18°.

- 5 24. Device according to at least one of claims 1 to 23, characterised in that it is made from thermoplastic polymer compositions from the group consisting of polyethylenes (PE), polypropylenes (PP), ethylene / propylene copolymers and blends of them, polyamides (PA), polystyrenes (PS),  
10 acrylonitrile-butadiene-styrene (ABS) copolymers, styrene-acrylonitrile (SAN) copolymers, polyvinyl chlorides (PVC), polycarbonates (PC), polymethyl methacrylate (PMMA), polyethylene terephthalates (PET) used alone or mixed.
- 15 25. Device according to claim 24, characterised in that at least one natural or synthetic thermoplastic elastomer is associated with the thermoplastic compositions, the elastomer(s) used preferably being chosen from the group composed of natural rubber or synthetic rubber type  
20 elastomers, and particularly rubbers based on mono-olefins for example such as polymers of isobutene / isoprene, ethylene vinyl acetate (EVA), ethylene-propylene (EPR), ethylene-propylene-diene (EPDM), ethylene-acrylic esters (EMA-EEA), fluorinated polymers, diolefin rubbers for  
25 example such as polybutadienes, styrene-butadiene (SBR) copolymers, rubbers based on condensation products for example such as polyester or polyurethane thermoplastic rubbers, silicones, styrenic rubbers, styrene-butadiene-styrene (SBS) and styrene-isoprene-styrene (SIS).

26. Device according to at least one of claims 1 to 25 characterised in that it is made in a single part according to plastics methodologies.

- 5 27. Application of the device according to claims 1 to 26 for leak-tight sealing and ambient air purification treatment of packaging containers for products sensitive to gaseous pollutants.